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Amended

maintaining said workpiece at a temperature between 100 and 500 degrees Celsius.

REMARKS

In the Office Action, the Examiner noted that claims 1-34 are pending in the application, the claims 18-34 are withdrawn from consideration, and that claims 1-17 are rejected. In view of the above amendments and the following discussion, the Applicant submits that none of the claims now pending in the application are indefinite under the provisions of 35 U.S.C. §112, anticipated under the provisions of 35 U.S.C. §102, or obvious under the provisions of 35 U.S.C. §103. Thus, the Applicant believes that all of these claims are now in condition for allowance.

I. ELECTION/RESTRICTIONS

The Examiner has requested to affirm a provisional election of an invention of claims 1-17.

In response, the Applicant confirms election of an invention of claims 1-17. Thus, the claims 18-34 are withdrawn from consideration, without traverse.

II. REJECTION OF CLAIMS UNDER 35 U.S.C. §112

The Examiner rejected claim 17 as being Indefinite for failing to particularly point out and distinctly claim the subject matter that the Applicant regards as the invention. Specifically, the Examiner stated that in claim 17, line 10, the limitation "said sulfur dioxide gas" lacks antecedent basis.

The Applicant amended claim 17 to recite the limitation "said carbon monoxide gas" that has support in the claim (line 4), as well as in Specification (page 7, paragraph 00025, line 6).

Thus, the Applicant submits that claim 17, as it now stands, fully satisfies the requirements of 35 U.S.C. §112.

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III. REJECTION OF CLAIMS UNDER 35 U.S.C. §103(a)

The Examiner rejected claims 1-17 as being unpatentable over the Kim et al. patent (United States patent 6,284,146 B1, issued Sep. 4, 2001). The rejection is respectfully traversed.

Kim et al. teaches etching a film of a transition metal, specifically W, Mo, Ru, Fe, Ir, Rh, Pt, Ni, Cu, and Au (col. 4, lines 29-33; Table 1), using an etching gas mixture that comprises chlorine and carbon monoxide (col. 3, lines 15-27). Specifically, Kim et al. teaches etching a lower electrode of a capacitor on a semiconductor substrate 13 (col. 4, lines 22-37). A lower electrode film is formed from the transition metal and supplied with a mask that is patterned for etching the electrode. Kim et al. describes, layer by layer, a film stack of the capacitor having such lower electrode and teaches etching a film of the transition metal using the etching gas mixture comprising chlorine and carbon monoxide. The film stack of the capacitor comprises, starting from the substrate 13, a diffusion barrier layer (Ti or TiN layer), a film of transition metal, a BST, STO, PZT, or PLZT layer, and the mask (photoresist, nitride, or oxide mask).

No subject matter related to etching a dielectric material and, specifically, etching the material having a high dielectric constant (e.g., BST, STO, PZT, or PLZT) is found in the patent to Kim et al.

The Examiner's attention is directed to the fact that Kim et al. does not teach a method of etching the BST, STO, PZT or PLZT layer. Furthermore, Kim et al. does not teach a method of etching any dielectric layer. On contrary, Kim et al. teaches away from etching a dielectric layer by selecting control parameters of the etch process in a manner that increases the etch selectivity to the transition metal (Pt) over a dielectric material (SiO₂) (Figures 3, 5, 7; col. 8, lines 8-14, 51-57; col. 9, lines 9-16). In manufacture, the component films of the film stack of a capacitor are deposited and etched in inverse orders, i.e., the dielectric layer of the capacitor is etched prior to etching the lower electrode. Then, during etching the lower electrode, a remaining portion of the dielectric layer is protected by the mask. As such, Kim et al. had no motivation to teach etching the dielectric layer.

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Therefore, Kim et al. do not teach, suggest, or otherwise render obvious a method of etching a layer of dielectric material having a dielectric constant that is greater than 4, as recited in Applicant's independent claims 1 and, in reference to a layer of hafnium-oxide, in amended independent claim 17. Specifically, claim 1 positively recites:

"A method of plasma etching a layer of dielectric material having a dielectric constant that is greater than 4 comprising the steps of:
exposing said dielectric material layer to a plasma comprising a reducing gas and a halogen containing gas." (emphasis added).

Amended independent claim 17 recites similar subject matter. In particular, the Applicant has amended claim 17 to correct a typo.

In contrast, Kim et al. does not teach or suggest etching a layer of dielectric material having a dielectric constant that is greater than 4. Therefore, the Applicant contends, that claims 1 and 17 are patentable over Kim et al. and, as such, fully satisfy the requirements of 35 U.S.C. §103 and are patentable thereunder.

Furthermore, claims 2-16 depend, either directly or indirectly, from claim 1 and recite additional features therefor. Since Kim et al. would not produce Applicant's invention as recited in claim 1, dependent claims 2-16 are also not obvious and are allowable.

CONCLUSION

Thus, the Applicant submits that none of the claims presently in the application are indefinite under the provisions of 35 U.S.C. §112, or obvious under the provisions of 35 U.S.C. §103. Consequently, the Applicant believes that all these claims are presently in condition for allowance. Accordingly, both reconsideration of this application and its swift passage to issue are earnestly solicited.


If, however, the Examiner believes that there are any unresolved issues requiring adverse final action in any of the claims now pending in the application, it is requested that the Examiner telephone Patricia A. Verlangieri, Esq. at (732) 530-9404 so that

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appropriate arrangements can be made for resolving such issues as expeditiously as possible.

Respectfully submitted,

2/5/03


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APPENDIX 1
Marked-Up Claims

Please rewrite claim 17 as follows:

17. (Amended) A method for plasma etching a workpiece having a layer of hafnium-oxide comprising the steps of:

supplying between 20 to 300 sccm of chlorine and between 2 to 200 sccm of carbon monoxide;

maintaining a gas pressure of between 2-100 mTorr;

applying a bias power to a cathode electrode of between 5 to 100 W;

applying power to an inductively coupled antenna of between 200 to 2500 W to produce a plasma containing said chlorine gas and said carbon monoxide [sulfur dioxide] gas;

maintaining said workpiece at a temperature between 100 and 500 degrees Celsius.